

CLAIMS

What is claimed is:

1. A device for the re-condensation by means of a cryo-generator of low boiling gases evaporating from a liquid gas container having a tubular neck (8) with an end flange and extending from said end flange into said liquid gas container and having at its end in said gas container a cold area (26), a cooling device, a so-called cold head, comprising a regenerator (21) and a pulse tube (23) with a heat exchanger (25) disposed therebetween supported on said tubular neck (8), said heat exchanger (25) being contained in said cold area (26), said regenerator (21) and said pulse tube (23) of said cooling device being each surrounded by a thermally insulating heat shield (29, 30, 31, 32), a heat transfer ring (10) arranged in said tubular neck (8) and having an annular recess, said cold area (26) having annular projections extending into said annular recess in said heat transfer ring (10) in spaced relationship with the walls of said recess, whereby a gas passage from the vapor space above the liquid gas both in said container to the cooling device is provided, and said cold head and said tubular neck (8) are axially movable relative to each other to permit different thermal expansions.

2. A device according to claim 1, wherein said cooling device has at least two stages disposed in said tubular neck (8) of said liquid gas container (2), each having a cold area (26, 28), which is removable and re-installable without the need for heating the liquid gas bath,

each stage of said cooling device consists of a regenerator (21) or (22) with a heat exchanger (25, 27) disposed therebetween, each of said heat exchanger (21) including a cold area (26, or respectively, 28),

the cold surface (28) of the last stage has an exposed surface extending into the cold vapor space of said liquid gas container (2),

said regenerator (21) and said pulse tube (23, 24) of the various stages of said cooling device are surrounded each by a shield of a thermally insulating material (20, 30, 31, 32),

all cold areas except for the last one, are disposed toward a subsequent stage adjacent a heat transfer ring (10) supported in the tube neck (8) at a particular location in a good heat transfer position therewith, and

a cold area (28) extends into an annular recess in the heat transfer ring (10) so that they are equidistantly spaced from the recess walls thereof and do not touch said walls, whereby a gas passage from the vapor space above the liquid gas bath to the beginning of the first cooling stage exists, and said cold head extending into said tubular neck (8) which is supported on said flange (33) mounted on the container wall (3) and each can expand thermally without coming into contact therewith.

3. A device according to claim 1, wherein said heat shield 20, 30, 31, 32 consists of a material with low heat conductivity.

4. A device according to claim 1, wherein said thermally insulating heat shield (29, 30, 31, 32) comprises a vacuum chamber extending around said container and having an outer wall consisting of a thin-walled tube, which is provided with stiffening means so as to be able to withstand the ambient pressure.

5. A device according to claim 4, wherein said stiffening means consist of a material with low heat conductivity.

6. A device according to claim 5, wherein said stiffening means is a rope wound helically around the outer wall of said vacuum chamber.

7. A device according to claim 5, wherein said stiffening means are rope sections disposed on the outer wall of said vacuum chamber of a line.

8. A device according to claim 4, wherein said outer wall comprises a thin-walled corrugated tube whose inner open diameter is slightly larger than that of the component surrounded thereby so that, if contact is established between said corrugated tube and the component surrounded thereby, such contact is only point-like or at most over a short length of a line.

9. A device according to claim 4, wherein said outer wall (29, 30, 31, 32) is a thin-walled tube provided with indentations or line-like reinforcement areas projecting toward the component surrounded by the thin-walled tube.

10. A device according to claim 8, wherein said elements of a material with low heat conductivity are disposed on the component surrounded by said thin-walled corrugated tube in order to maintain a predetermined gap between said thin-walled corrugated tube and the component surrounded thereby.

11. A device according to claim 1, wherein each cold area (28) is provided with at least one bore (37a) evenly distributed around the circumference to permit gas flow through said cold area (26).